

MCX128

Memory Expansion for the MC-10

Hardware Information

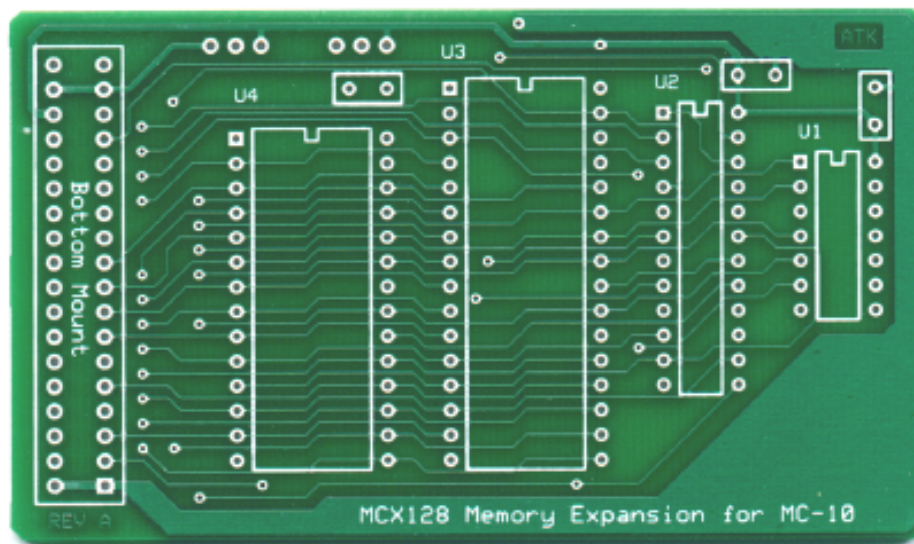
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Overview

The MCX128 is a memory expansion module for the TRS-80 MC-10 Micro Color Computer. The module includes the following features:

- 128K RAM (utilizing Bank Selection).
- 16K EPROM.
- Four Memory Map modes for the ROM region (C000-FFFF):
 - 16K External ROM
 - 8K RAM / 8K External ROM
 - 8K RAM / 8K Internal ROM
 - 16K RAM
- Software control of RAM Bank selection and Memory Map Mode.

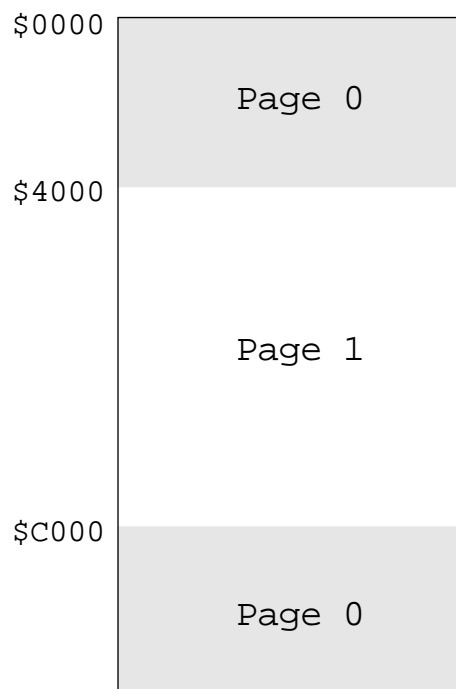


Memory Map

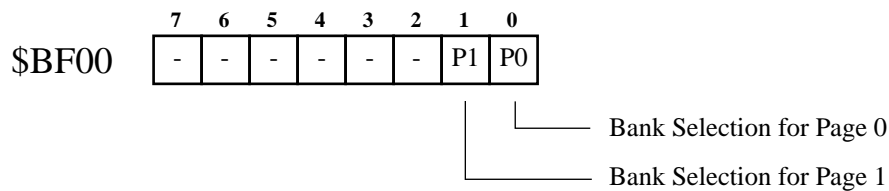
0000 - 0003	6803 Ports
0004 - 0007	Expansion RAM
0008 - 000E	6803 Status / Control
000F	Expansion RAM
0010 - 0013	6803 UART
0014	6803 RAM Control Reg
0015 - 001F	Unused
0020 - 007F	Expansion RAM
0080 - 00FF	On-chip CPU RAM / Expansion RAM
0100 - 3FFF	Expansion RAM
4000 - 4FFF	Built-In RAM / Expansion RAM
5000 - BEFF	Expansion RAM
BF00	RAM Bank Control Reg
BF01	ROM Map Control Reg
BF80 - BFFF	Keyboard / VDG / Sound
C000 - DFFF	EPROM or Expansion RAM
E000 - FFFF	Built-in ROM, EPROM or Expansion RAM

RAM Banks

The MCX128 divides the 64K address space into two 32K pages. Page 0 is non-contiguous and covers the first 16K (0000-3FFF) and last 16K (C000-FFFF) of the address space. Page 1 covers the middle 32K (4000-BFFF) and corresponds to the region where the internal 4K and stock 16K expansion RAM would reside.



Each of these pages can be independently switched between two banks of RAM. The value stored in the **RAM Bank Control Register** (BF00) determines which banks are active. The register can be read from, as well as written to:



Bank selection does not affect addresses 0080-00FF if they are mapped to the 6803 CPU's on-chip RAM (default).

The region from C000-FEFF is only affected by bank selection for addresses that are mapped to RAM by the ROM Map Control Register (see below). When the 16K RAM map mode is active, the upper 256 bytes of the address space (FF00-FFFF) are always mapped to bank 0 (the 256 bytes in bank 1 are never accessible).

The VDG always reads video RAM from Bank 0 regardless of the current bank selection for page 1.

Built-In RAM

The MC-10's 4K built-in RAM (4000-4FFF) is accessed when Bank 0 is selected for Page 1. Selecting Bank 1 maps this area to the RAM on the MCX128. The video display always uses the built-in RAM, so writing to this area while Bank 1 is selected does not affect the display.

RAM for BASIC

RAM available to stock MicroColor Basic is now nearly 32K (4000-BEFF). The 256 bytes from BF00-BFFF are not mapped to RAM in order to retain access to the Keyboard, VDG and Sound hardware as well as to provide addressable locations for the RAM Bank and ROM Map control registers.

The extended version of MicroColor Basic (MCX Basic) can use the entire 48K region from 0020 to BEFF, while managing the video display as a separate RAM bank.

Direct Page RAM

There are 101 additional Direct Page addresses that can be utilized:

- 0004 - 0007
- 000F
- 0020 - 007F

Each of these addresses are also affected by the RAM Bank selection for Page 0, providing 202 physical storage locations.

The 6803's RAM Control Register (0014) can now be used to switch the address space of 0080 - 00FF between the on-chip CPU RAM and the RAM on the MCX128. If the CPU's on-chip RAM is enabled (default), writes to this area are mirrored by the RAM on the MCX128.

ROM Region

The MCX128 includes a socket for a 16K EPROM. Because the system starts up in 16K External ROM mode, an EPROM must be present to boot the MC-10. The ROM region (C000-FFFF) is sub-divided into two 8K sections. The value stored in the ROM Map Control Register (see below) determines how the two sections are used.

ROM Map Control Register

Reading from the two 8K ROM areas can obtain data from ROM or RAM depending on the value stored in the ROM Map Control Register (BF01). Reading the lower portion (C000-DFFF) can access either RAM or the external EPROM. Reading the upper portion (E000-FFFF) can access RAM, the external EPROM or the built-in ROM.

NOTE: *Writes to the ROM region always go to RAM.*

The ROM Map Control Register may be read from, as well as written to:

